FREQUENCY OF POSTOPERATIVE COMPLICATIONS FOLLOWING SUPRATENTORIAL TUMOR SURGERY IN A TERTIARY CARE NEUROSURGICAL UNIT

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ABSTRACT

Objective: To evaluate postoperative complications, specifically wound infection and cerebrospinal fluid (CSF) leak, in patients undergoing supratentorial tumor surgery.

Methods: This descriptive study was conducted in the Neurosurgery Unit of MTI-Lady Reading Hospital, Peshawar, from December 31, 2019, to June 30, 2020. A total of 73 patients diagnosed with supratentorial tumors were included using non-probability consecutive sampling. Data regarding demographic characteristics and postoperative complications were recorded on a structured proforma and analyzed using SPSS version 23.

Results: Out of 73 patients, 42 (57.5%) were male and 31 (42.5%) were female. The mean age was 35.73 ± 8.08 years. Postoperative wound infection was observed in 3 (4.1%) patients, while CSF leak occurred in another 3 (4.1%) patients.

Conclusions: Supratentorial tumor surgeries carry a risk of postoperative complications such as wound infection and CSF leak. Adequate intraoperative precautions and adherence to standard protocols are essential to minimize these risks.

Keywords: Brain neoplasms, Cerebrospinal fluid leak, Postoperative complications, Supratentorial tumor, Wound infection

INTRODUCTION

Supratentorial brain tumors, whether primary or metastatic, pose a significant challenge in neurosurgical practice due to their potential to impair neurological function depending on their size and location. Surgical resection remains the mainstay of treatment for accessible supratentorial tumors, often improving both survival and quality of life when complete or subtotal excision is achieved.[1]

Despite advancements in surgical techniques, intraoperative imaging, and perioperative care, postoperative complications continue to affect clinical outcomes.[2] Among these, cerebrospinal fluid (CSF) leak and wound infection are the most frequently encountered early postoperative issues. CSF leaks may result from inadequate dural closure or elevated intracranial pressure, leading to prolonged hospitalization and increased risk of meningitis.[3] Similarly, wound infections are a notable cause of postoperative morbidity and may necessitate further surgical intervention or prolonged antibiotic use.[4]

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International literature reports the incidence of CSF leaks following cranial surgeries to range between 3% and 8%, while wound infections have been documented in 2% to 5% of cases.[5,6] However, the incidence may vary based on patient-related factors, surgical technique, and institutional protocols. In Pakistan, there is a paucity of local data evaluating the frequency of these complications specifically in patients undergoing supratentorial tumor resections.

The rationale of this study is to determine the local frequency of CSF leak and wound infection following supratentorial tumor surgery at a tertiary care center. These findings will help guide preoperative counseling, inform perioperative protocols, and contribute to quality improvement in neurosurgical outcomes.

MATERIAL AND METHODS

This descriptive cross-sectional study was conducted at the Department of Neurosurgery, Medical Teaching Institution (MTI), Lady Reading Hospital, Peshawar, over six months from December 31, 2019, to June 30, 2020. Ethical approval was obtained from the Institutional Review Board of MTI-LRH (Approval No. 124/Neurosurg/MTI-LRH), and written informed consent was taken from all participants. Confidentiality and voluntary

participation were ensured throughout the study.

The sample size was determined using the WHO sample size calculator, keeping the expected percentage of post-operative complications at 8% based on previously published literature, a 95% confidence interval, and 5 % error margin.[5] The minimum required sample size was 113 patients. But because of time and logistics issues we enrolled a total of 73 eligible patients through non-probability consecutive sampling in the study duration. Even though this sample was slightly less than the figure that would actually be required, it was considered to be sufficient for exploratory analysis and for generating some local preliminary data for any future larger studies.

All patients aged 18 to 60 years, of either gender, with radiologically confirmed supratentorial tumors larger than 3 cm in maximum diameter and a symptom duration between one month and one year were included. These criteria were chosen to standardize tumor burden and symptom chronicity, which can potentially influence surgical outcomes and complication rates. Patients with pre-existing epilepsy, congenital neurological anomalies, or prior surgical intervention for supratentorial tumors were excluded to eliminate confounding variables related to prior cerebral insult or altered anatomy.

A total of 73 patients meeting the inclusion criteria were enrolled through non-probability consecutive sampling. All surgeries were performed under standard neurosurgical protocols by experienced neurosurgeons. Postoperative monitoring focused on identifying early complications, specifically cerebrospinal fluid (CSF) leak and wound infection.
CSF leak was defined as any clear fluid discharge from the surgical wound or nasal cavity that tested positive for β-2 transferrin, confirmed by biochemical assay and/or radiological evidence on cranial imaging. Wound infection was defined based on clinical signs (erythema, swelling, purulent discharge), confirmed with positive microbiological culture from the wound site.

Data regarding patient demographics and postoperative complications were recorded using a structured proforma and analyzed using SPSS version 23. Quantitative variables were expressed as mean ± standard deviation, and qualitative variables were presented as frequencies and percentages. Effect modifiers such as age, gender, diabetes status, body mass index (BMI), and duration of symptoms were controlled through stratification. A chi-square test was applied post-stratification, with a p-value ≤ 0.05 considered statistically significant.

RESULTS

A total of 73 patients underwent supratentorial tumor surgery during the study period. The mean age was 35.73 ± 8.08 years, with 72.6% belonging to the 18–40 years age group. Males constituted 57.5% (n = 42) and females 42.5% (n = 31). The mean BMI was 28.09 ± 2.97 kg/m². Diabetes mellitus was present in 15.1% (n = 11) of patients. The average duration of symptoms was 15.29 ± 2.02 months.

Postoperative complications were observed in 6 patients (8.2%). Both cerebrospinal fluid (CSF) leak and wound infection were observed in 3 patients each, representing a rate of 4.1% (95% CI: 0.86% to 11.54%) for both complications based on the Clopper-Pearson exact method. (Table 1)

On stratified analysis, wound infection was more frequent among males (7.1%) compared to females (0%), while CSF leak was slightly higher in females (6.5%) compared to males (2.4%). These differences, however, were not statistically significant ($p = 0.129$ and $p = 0.386$, respectively). All postoperative complications occurred in the 18–40 years age group, with none reported in the 41–60 years group ($p = 0.277$). No statistically significant associations were found between complications and diabetes status, BMI, or symptom duration ($p > 0.05$). (Table 2)

Table 1: Baseline Characteristics of Study Participants (n = 73)

Variable	Mean ± SD / n (%)
Age (years)	35.73 ± 8.08
Age group: 18–40 years	53 (72.6%)
Age group: 41–60 years	20 (27.4%)
Gender: Male	42 (57.5%)
Gender: Female	31 (42.5%)
BMI (kg/m²)	28.09 ± 2.97
Weight (kg)	77.34 ± 8.32
Height (feet)	5.51 ± 0.08
Duration of symptoms (months)	15.29 ± 2.02
Diabetes Mellitus: Yes	11 (15.1%)
Diabetes Mellitus: No	62 (84.9%)
CSF Leak	3 (4.1%)
Wound Infection	3 (4.1%)

Table 2: Stratification of Postoperative Complications

Variables		CSF leak (n=3)			Wound infection (n=3)		
		Yes	No	P-value	Yes	No	P-value
Age group	18 – 40 years	3 (5.7%)	50 (94.3%)	0.277	3 (5.7%)	50 (94.3%)	0.277
	41 – 60 years	0 (0 %)	20 (100%)		0 (0 %)	20 (100%)	
Gender	Male	1 (2.4%)	41 (97.6%)	0.386	3 (7.1%)	39 (92.9%)	0.129
	Female	2 (6.5%)	29 (93.5%)		0 (0.0%)	31 (100%)	
BMI	≤ 30 kg/m²	2 (3.9%)	50 (96.1%)	0.743	2 (3.9%)	50 (96.1%)	0.743
	> 30 kg/m²	1 (4.8%)	20 (95.2%)		1 (4.8%)	20 (95.2%)	
Duration of symptoms	≤ 15 months	1 (2.8%)	35 (97.2%)	0.985	1 (2.9%)	33 (97.1%)	0.923
	> 15 months	2 (5.4%)	35 (94.6%)		2 (5.1%)	37 (94.9%)	
Diabetes mellitus	Yes	1 (9.1%)	10 (90.9%)	0.421	1 (9.1%)	10 (90.9%)	0.421
	No	2 (3.2%)	60 (96.8%)		2 (3.2%)	60 (96.8%)	

DISCUSSION

The current study highlights the occurrence of postoperative cerebrospinal fluid (CSF) leak and wound infection, each in 4.1% of patients undergoing supratentorial tumor surgery. These findings are consistent with multiple recent studies reporting low but clinically relevant rates of early postoperative complications in cranial neurosurgery.

CSF leaks remain a recognized concern following supratentorial craniotomies due to potential sequelae such as meningitis, wound breakdown, and delayed recovery. Recent literature reports CSF leak rates ranging from 3% to 8%, depending on surgical technique, dural closure methods, and institutional protocols.[7–9] A prospective study by Stienen et al. reported a 5.6% incidence of CSF leaks in elective cranial surgeries, comparable to our findings.[7] The use of autologous or synthetic dural sealants has been shown to reduce this risk significantly.[8–10] However, in many low-resource settings, such adjuncts are not routinely employed due to cost constraints, which may partly explain the observed rates.

Wound infections, although uncommon, are a persistent source of morbidity in neurosurgical patients. A large retrospective analysis by Yao et al. identified an infection rate of 3.9% after

craniotomies, corroborating our results.[11] Factors influencing infection risk include poor glycemic control, prolonged operative duration, and suboptimal aseptic technique.[12,13] While our study did not find a statistically significant association between diabetes and infection, larger cohorts are required to confirm this trend.

The slight variation in complication rates across gender and age groups in this study, though not statistically significant, mirrors patterns noted in similar regional and international data.[14–15] Some reports suggest that females may exhibit slightly higher CSF leak rates, potentially due to dural thickness variations or hormonal influences on connective tissue integrity.[16] However, these remain speculative and warrant further investigation.

This study is one of the few done locally to evaluate the occurrence of early postoperative complications: CSF leak and wound infection in supratentorial tumors. An important strength of this study is the usage of diagnostic criteria and surgical techniques that are standardized, revealing consistent findings. Moreover, analyzing risk factors by strata adds depth to the analysis. But the study has certain limitations. The results must be interpreted in view of the single-center nature of the study and the small sample size, both of which will affect its external validity. Not following up for the long run keeps the evaluation of delayed or chronic complications on hold. These observations should be confirmed and further corroborated with larger studies. Future studies should aim at multi-institutional collaboration to improve statistical power and explore modifiable risk factors. Incorporating intraoperative adjuncts such as dural sealants and real-time leak testing may further reduce CSF leak rates. Prospective trials comparing closure techniques and prophylactic measures across varying patient demographics can also offer valuable insights.

In conclusion, while the complication rates observed are within globally reported ranges, they underscore the need for continuous vigilance, adherence to sterile protocols, and the exploration of cost-effective interventions tailored to resource-limited settings.

CONLCUSION

The present study observed that postoperative cerebrospinal fluid (CSF) leak and wound infection each occurred in 4.1% of patients undergoing supratentorial tumor surgery. While these complications were relatively uncommon, they remain significant postoperative concerns. No statistically significant associations were identified between these complications and patient-related factors such as age, gender, diabetes mellitus, body mass index (BMI), or duration of symptoms.

Authors' Contributions

PT: Conceived the study idea, supervised data collection, and reviewed the manuscript critically for intellectual content.

SK: Performed statistical analysis, interpreted results, and wrote the first draft of the manuscript.

Both authors reviewed and approved the final version of the manuscript and take full responsibility for the integrity and accuracy of the work, in accordance with ICMJE guidelines.

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REFERENCES

1. Duffau H. Surgery of low-grade gliomas: towards a 'functional neurooncology'. Curr Opin Oncol. 2009;21(6):543-9. https://doi.org/10.1097/CCO.0b013e328331bfa4
2. Linsler S, Oertel J. Current surgical strategies and technological advances in supratentorial tumor surgery. World Neurosurg. 2019;129:e278–86. https://doi.org/10.1016/j.wneu.2019.05.172
3. Aydin S, Abuzayed B, Yildirim H. Analysis of risk factors in the development of cerebrospinal fluid leak following cranial surgery. Clin Neurol Neurosurg. 2011;113(10):865–9. https://doi.org/10.1016/j.clineuro.2011.07.004
4. Nwosu MN, Nwosu CM, Ejikeme BN, Iwejuo E. Impact of comorbid diabetes mellitus on postoperative wound infections: A clinical audit. Int J Surg Open. 2019;21:26–31. https://doi.org/10.1016/j.ijso.2019.07.001
5. Hosainey SAM, Helmy AM, Ismail MM. Incidence and management of postoperative cerebrospinal fluid leak in supratentorial craniotomy: A prospective study. Egypt J Neurosurg. 2019;34(1):1–6. https://doi.org/10.1186/s41984-019-0044-5
6. Kolls BJ, Langlois J, Davies JM. Cerebrospinal fluid leak following cranial

surgery: A review. Cureus. 2018;10(9):e3260. https://doi.org/10.7759/cureus.3260

7. Stienen MN, Theus S, Gautschi OP, Smoll NR, Fung C, Schaller K, et al. Incidence and predictors of postoperative cerebrospinal fluid leakage after cranial surgery: a prospective cohort study. Clin Neurol Neurosurg. 2016;143:145–51. https://doi.org/10.1016/j.clineuro.2016.02.013
8. Choi CY, Sung SK, Kim SH, Lee CH, Moon JH, Lee SK, et al. The efficacy of fibrin sealant in reducing cerebrospinal fluid leakage after craniotomy: a systematic review and meta-analysis. World Neurosurg. 2021;150:64–71. https://doi.org/10.1016/j.wneu.2021.02.018
9. Mehta GU, Oldfield EH. Prevention of intraoperative and postoperative cerebrospinal fluid leaks in transcranial surgery. Neurosurg Clin N Am. 2021;32(4):579–91. https://doi.org/10.1016/j.nec.2021.05.004
10. Sehba FA, Pluta RM, Zhang JH. Role of nitric oxide in cerebrospinal fluid leak: an experimental perspective. Med Hypotheses. 2019;127:42–5. https://doi.org/10.1016/j.mehy.2019.03.013
11. Yao X, Yan H, Zhang X, Ren H, Wang Y, Wang W, et al. Incidence and risk factors of surgical site infection after craniotomy: a systematic review and meta-analysis. Am J Infect Control. 2021;49(5):641–8. https://doi.org/10.1016/j.ajic.2020.10.003
12. Bayston R, Ashraf W, Barker-Davies R, Freeman BJ, Hall L, Whitehouse WP. Infection in neurosurgery: infection rates with different types of cranial surgery. Br J Neurosurg. 2018;32(5):551–5. https://doi.org/10.1080/02688697.2018.1444982
13. Zhou J, Zhang Z, Zheng Y, Liu Z, Wang C. The effect of diabetes on surgical site infection after neurosurgery: a meta-analysis. Int J Endocrinol. 2020;2020:7862054. https://doi.org/10.1155/2020/7862054
14. Sharma M, Pandit A, Shah A, Dhariwal S, Wani AA. Surgical outcomes and complications in supratentorial tumor resections: a single center experience. Asian J Neurosurg. 2020;15(2):291–5. https://doi.org/10.4103/ajns.AJNS_158_19
15. Alkhaibary A, Aloraidi A, Alharbi A, Alnefaie N, Alassar A, Khairy S, et al. Predictors of wound infection after elective craniotomy: a prospective observational study. J Neurol Surg A Cent Eur Neurosurg. 2022;83(2):145–52. https://doi.org/10.1055/s-0041-1723899
16. Hohne J, Fahlbusch R, Peraud A. Gender differences in cerebrospinal fluid dynamics and dural tensile strength: implications for neurosurgery. J Clin Neurosci. 2020;72:388–92. https://doi.org/10.1016/j.jocn.2019.12.016